

A new cotton crop protection programme in Cameroon



Note: all prices quoted in CFA francs were before the devaluation.

In 1992, 13 000 ha of cropland was treated by cotton producers in Cameroon as part of a new pesticide protection programme developed by the Cameroonian Institut de recherche agronomique. Scientists have tested very low pesticide doses to address the economically motivated wishes of farmers and development agents to minimize pesticide use. This unique operation in French-speaking Africa was welcomed by the agricultural community: effective, inexpensive and environment-friendly.

Since 1976, the Société de développement du coton du Cameroun (SODECOTON) has been using the ultra low volume (ULV) spraying technique extensively for pesticide treatments at doses of 3 l/ha.

This technique, however, is relatively ineffective in controlling homoptera (aphids and aleurodes) due to insufficient pesticide coverage in the middle and at the base of sprayed cotton plants. These pests became a major problem in the 1980s, prompting further research and subsequent development of the very low volume (VLV) spraying technique at 10 l/ha, using water as the solvent. Approximately 2 000 ha of cotton cropland were treated by this technique in 1991.

Extension of this new technique led to experiments on alternative pest control strategies. The control

programmes derived from this research are more cost-effective, provide sufficient pest protection, are well adapted to cotton cropping conditions in Cameroon and are environment-friendly.

Staggered-targeted control

Of the five proposed control programmes (inset on the next page), the best results so far, in terms of control effectiveness and treatment cost, have been obtained with "staggered-targeted control" (Tables 1 and 2). In high pest-pressure situations, as occurred in the southeastern Bénoué region in 1992, staggered-targeted control provided more effective pest protection than the conventional "dose-frequency control" programme. The efficiency of the staggered-targeted technique is enhanced by the fact that active ingredients and dosages can be modified according to the magnitude of the pest outbreak.

The staggered-targeted control programme is appropriate for the agricultural environment in Cameroon and reassuring for smallholders. Indeed, smallholders can preschedule

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Five pesticide control programmes for cotton

The conventional ultra low volume (ULV) control programme

This is a scheduled programme. Six or seven ULV spraying treatments are conducted every 14 days from day 45 after emergence, with ready-to-use formulations (1-3 l/ha). This has been the most widely-used programme in Cameroon over the last 15 years or so.

The dose-frequency control programme

This is a scheduled programme that begins on day 45 after emergence. There are 12-14 VLV treatments conducted on a 7-day basis, using one third the standard dose of the conventional ULV programme. The active ingredient doses are reduced because of the increased spraying frequency.

This programme has been successfully extended since 1989 despite the increased labour involved, with an estimated 25-30% savings as compared to the conventional programme.

The staggered control programme

The staggered control programme begins on day 45 after emergence, with a VLV leaf application every 14 days, and a total of 6-7 treatments per crop season. The active ingredients are predetermined, but the doses are set after a field survey carried out the day before treatment. This was a forerunner to the staggered-targeted control programme.

Farmers can save 30% by using this programme as compared to the conventional technique.

The staggered-targeted control programme

The schedule for this programme is the same as that described for staggered control. However, both the type of active ingredients and doses are determined after a field survey carried out the day before treatment. The spraying treatments are conducted at very low volume.

This staggered-targeted control programme was tested on 2 000 ha in 1991 and 13 000 ha in 1992, resulting in 50% savings as compared to the conventional control programme.

The *sensu stricto* intervention threshold control programme

With this programme, the treatment dates, active ingredients and doses are determined after a pest survey in the field.

This programme was tested on 10 ha under normal field conditions in 1991, resulting in 65% savings as compared to the ULV programme. However, farmers and extension agents have to be fully trained on how to implement the programme. It has not yet been adapted for large-scale applications, but this would be of interest so that farmers could manage their own smallholdings.

Table 1. Pesticide protection cost breakdown: including pesticide compounds, batteries, equipment depreciation and observer allowances (CFA francs/ha).

Programme	1989	1990	1991
Conventional ULV*	20 870	15 800	15 800
Staggered VLV control	14 540	—	—
Staggered-targeted VLV control	—	7 950	7 180

* Last treatment cancelled in 1990 and 1991.

1 French franc = 50 CFA francs

\$1 US = 290 CFA francs

Table 2. Pesticide compound saving, expressed as a percentage of quantities used in a conventional programme.

Conditions	Pyrethrinoids	Organophosphorus	
		acaricides	aphicides
Staggered control (1988 test)	41	30	50
Staggered control (1989, pre-extension)	32	50	45
Staggered-targeted control (1990, test)	48	100	50
Staggered-targeted control (1990 pre-extension)	44	99	54
Staggered-targeted control (1991, test)	50	100	24
Staggered-targeted control (1991, pre-extension)	46	0	48

Test: research station plot. Pre-extension: field plot.

treatment dates and, after consulting with SODECOTON, decide upon what products and doses to use for the best control results against specific pests; they can therefore adjust their budgets according to needs. With the assistance of extension agents, field surveys are quite easy to carry out, i.e. pest insect detection is facilitated by the fact that no endophagous caterpillars are present.

Finally, this method is suitable for the relatively mild environments often encountered in Cameroon, i.e. damage is limited and thus crop yields are one third higher than obtained without treatment.

Technical implementation

Since 1990, SODECOTON has been steadily extending the staggered-targeted control programme through some *Associations villageoises auto-gérées* (AVA) — self-managed small-holder groups — that were chosen according to several criteria:

- experience with VLV spraying;
- the good reputation of the AVA, and farmers' receptiveness;
- the professional motivation and dedication of the AVA coordinator in charge of surveys and treatments.

Observation criteria and conditions

Data for 25 cotton plants are pooled for each observation criterion. The quadrat infestation value is the mean for all quadrats. This value is then compared to the intervention threshold (Table 3).

Carpophagous caterpillars

The observer counts the number of larvae on the cotton plant, with all species pooled, i.e. *Helicoverpa armigera*, *Diparopsis watersii*, and *Earias* spp.

Syllepte derogata

The observer notes the number of rolled leaves infested by at least one *Syllepte derogata* larva on a cotton plant. Note that scientists are studying other sampling techniques since a diagonal sample of 25 cotton plants does not always

provide a reliable estimate of the infestation levels for this species. This pest is sometimes clustered in patches which can be overlooked in the sampling.

Spider mites

The observer, while counting aleurode larvae, notes the presence (1) or absence (0) of spider mites.

Aphids

The observer counts the number of leaves, among the five subterminal leaves on the cotton plant, infested by at least one aphid.

Aleurode larvae

One leaf is cut from the middle part of the cotton plant. A 6.25 cm² area on the

under-surface of the leaf is then examined with a magnifying glass and aleurode larvae are counted.

Adult aleurodes

The observer shakes the cotton plant and assesses the resulting cloud of white flies:

0: no white flies

1: a few

2: many

3: large cloud.



Table 3. Chart to facilitate decision-making for staggered-targeted control under northern Cameroonian field conditions (for 25 cotton plants).

	1 st and 2 nd treatments		3 rd and 4 th treatments		5 th treatments +	
	Threshold	Dose	Threshold	Dose	Threshold	Dose
Pyrethrinoids						
– Carpophagous caterpillars	< 6	1/2	< 6	1/2	< 6	1/2
	≥ 6	1	≥ 6	1	≥ 6	1
Organophosphorus acaricides						
– <i>Syllepte derogata</i>	< 75	0	< 100	0	< 100	0
	≥ 75	1/2	≥ 100	1/2	≥ 100	1/2
– Spider mites	< 3	0	< 3	0	not to be considered	
	≥ 3 and < 5	1/2	or		not to be considered	
	≥ 5	1	≥ 5	1/2	not to be considered	
Organophosphorus aphicides						
– Aphids	< 19	0	< 38	0	< 38	0
	≥ 19 and < 31	1/2	≥ 38 and < 63	1/2	≥ 38 and < 63	1/2
	≥ 31	1	≥ 63	1	≥ 63	1
– Aleurode larvae	not to be considered		< 200	0	< 150	0
	not to be considered		≥ 200	1/2	≥ 150 and < 200	1/2
					≥ 200	1
– Aleurode adults	not to be considered		< 50	0	≥ 50	0
	not to be considered		> 50	1/2	≥ 50	1/2

Dose: 0 = no pesticide; 1/2 = half-dose; 1 = standard dose.



Aleurode larvae survey.
Photo J.-P. Deguine

Field operations

The AVA coordinators and zone agents are trained to implement the cotton block design at crop emergence. They square off the area in hectares, and then 2 500 m² per squared-off hectare is chosen randomly; this sample area is supposed to be representative of a smallholder unit or quadrat. Each quadrat is studied throughout the crop season.

The coordinator carries out an entomological survey of the quadrat one day before treatment. This usually takes one day, or two if the quadrat is larger than 15 ha.

From survey to treatment

The coordinator assesses 25 cotton plants chosen randomly along the diagonal of the quadrat, which takes about 30 min.

On each cotton plant, this observer looks for pests in the following order: adult aleurodes, aleurode and spider mite larvae, aphids, carpophagous caterpillars and finally *Syllepte derogata* caterpillars.

intervention thresholds established by the IRA (Institut de recherche agronomique in Cameroon) (Table 3).

Let us take, for instance, a 4 ha block which includes four observation quadrats, thus 4 x 25 cotton plants to assess. For the first treatment, the four carpophagous caterpillar counts are as follows: 6-5-7-8, i.e. a mean result of 6.5 for the whole block. This indicates that a normal pyrethrinoid dose should be sprayed. On the other hand, for the second treatment, the results of the counts are 3-2-4-1 (mean 2.5). In this case, a half-dose of pyrethrinoid would be enough to stall the infestation. This reasoning would also apply for the other pesticide compounds.

Successful pest control conditions

The staggered-targeted control programme offers many advantages, but training and follow-up are two factors that mark its widespread success. The policies adopted by SODECOTON are exemplary in this respect.

Spray treatment of a test block by a pest control team.

Photo J.-P. Deguine



In fact, training is provided for all development agents, including supervisors, field and basic staff, and AVA coordinators in charge of carrying out the preliminary surveys and calculating the active ingredient doses.

The apprenticeship culminates with blank tests, which are conducted just before the first cotton field treatments of less than 45 days. They focus on survey observations and treatment conditions.

Follow-up is the cotton producer's responsibility. This parameter is based on pest status observations at the study plot, and involves checking dose calculations and active ingredient choices and certifying that the AVA coordinators, who act as middlemen with the smallholders, are fully aware of the overall situation. A network of survey/early-warning test plots is now being contemplated.

Extension of the staggered-targeted control programme should be successful once these two conditions are consolidated, i.e. training and follow-up. In 1993, one third of the area intensively cropped with cotton (said to be "yielding") was treated under this programme.



Pesticide choice and dosage.
Photo J.-P. Deguine

Abstract... Resumen... Résumé

J.-P. DEGUINE, G. EKUKOLE — A new cotton crop protection programme in Cameroon.

Protection of cotton from pests and diseases in Cameroon covers three areas: cost reduction, conservation of the environment and effective control of pests. Research (IRA) and development (SODECOTON) institutions now propose very low volume insecticides used with new programmes. "Staggered-targeted control", the most suitable system for the Cameroon cotton belt, is a scheduled integrated programme. Spraying dates are programmed in advance at 2-week intervals from day 45 after emergence, but doses and active ingredients are determined according to pest numbers and types after observations in the field the day before spraying. Since its development in 1991, "Staggered-targeted control" has enabled cash savings of some 50% and is at least as effective as conventional spraying programmes. Finally, more account is taken of the environmental conservation criterion.

Keywords: cotton, *Gossypium hirsutum*, chemical pest control, insect pests, Cameroon.

J.-P. DEGUINE, G. EKUKOLE — Nuevo programa de protección del algodón en Camerún.

En Camerún, la protección fitosanitaria del algodón evoluciona en tres campos: la reducción de costes, la preservación del medio ambiente y la eficacia contra los animales dañinos. La investigación (IRA) y el desarrollo (SODECOTON) proponen actualmente tratamientos insecticidas a volumen muy bajo según nuevos programas. El más adaptado a la zona algodonera camerunesa, la "lucha dirigida escalonada", es un programa razonado en función del calendario. Las fechas de las aplicaciones son fijadas por adelantado, cada 14 días a partir del 45º día después del brote, pero las dosis y las materias activas se definen según la importancia y el tipo de animales dañinos basándose en observaciones efectuadas en el campo la víspera del tratamiento. Desde su desarrollo en 1991, la "lucha dirigida escalonada" ha permitido realizar ahorros de alrededor del 50% con una eficacia por lo menos igual a la de los programas tradicionales. Por último, el respeto del medio ambiente es un criterio mejor considerado.

Palabras clave: algodón, *Gossypium hirsutum*, lucha química, insectos dañinos, Camerún.

J.-P. DEGUINE, G. EKUKOLE — Nouveau programme de protection en culture cotonnière au Cameroun.

Au Cameroun, la protection phytosanitaire du cotonnier évolue dans trois domaines: la réduction des coûts, la préservation de l'environnement et l'efficacité contre les ravageurs, en particulier les insectes piqueurs suceurs. La recherche (IRA) et le développement (SODECOTON) proposent désormais des traitements insecticides à très bas volume selon de nouveaux programmes. Le plus adapté à la zone cotonnière camerounaise, la « lutte étagée ciblée », est un programme raisonné sur calendrier. Les dates des applications sont fixées à l'avance, tous les 14 jours dès le 45º jour après la levée. Mais les doses et les matières actives sont définies selon l'importance et le type de ravageurs, à partir des observations effectuées au champ la veille du traitement. Depuis son développement en 1991, la « lutte étagée ciblée » a permis des économies monétaires de l'ordre de 50 %, avec une efficacité au moins aussi bonne que les programmes classiques. Enfin, le respect de l'environnement est un critère mieux considéré.

Mots-clés: cotonnier, *Gossypium hirsutum*, lutte chimique, insecte ravageur, Cameroun.